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Contents

Scientific Editorial - Portland Cement – an alternative, effective and economical pulp repair agent.

Dr.Sanjay Jamdade | Associate Editor: Dental Follicle - The E Journal of Dentistry |

Abstract:

Objective: To verify claims about Portland cement being an effective and safe alternative to MTA in endodontic vital pulpotomy

Materials and Methods: A Portland cement vital pulpotomy was done and followed up for 17 months in a teenage boy. A coronal seal of composite 'fiber core' followed up with a composite build up was done shortly afterwards.

Results: radiological evidence of root end formation as well as dentinal bridge without any local adverse reaction whatsoever.

Conclusion: Portland cement works successfully as a pulpotomy agent and there is no negative inference to be drawn from the literature as yet regarding its efficacy and safety.

Abbreviations: - PC= Portland cement, MTA= Mineral Trioxide Aggregate, WMTA= White MTA, GMTA= Grey MTA, WPC= White Portland Cement, GPC= Grey Portland Cement

Mesh Key Words: Portland cement, PC, Mineral Trioxide Aggregate, MTA, Vital Pulp Therapy, Safety of Portland cement, Endodontic repair material.

Introduction

Mineral Trioxide Aggregate (MTA) is established as an endodontic perforation repair material as well as a vital pulp repair agent.17 It is also an expensive material. So ever since the launch of MTA researchers were attempting to find economical alternatives which will act similarly on the pulp and periodontal tissues.

It has always been known that MTA is derived either directly from Portland cement (PC) or both of them, MTA and PC, are derived from a common source. It was found that they both contain common elements, physical characteristics and have show similar biologic response. Researchers found that even histological reaction of human tissues was similar. Substituting MTA with PC did not change success rate in any way at all.

The safety profile of PC when compared to MTA was equally safe. Biocompatibility of MTA and PC were identical. The only noticeable prominent difference between the two was the presence of Bismuth oxide in MTA. The other being that MTA is pre-sterilized when sold and PC is not sold in pre-sterilized manner.

Irrespective of the lack of pre-sterilization PC has performed as well as MTA in all the studies presented.

The purpose of this paper is to confirm the findings of all the previously published papers which demonstrated the

effectiveness of PC as an endodontic repair material and a vital pulp therapy material at par with MTA.

MATERIALS AND METHODS –

Case report: -

A 14 year old boy presented with a fractured upper left central incisor with exposed pulp.

The trauma had taken place 2 days ago and the tooth pained only when it was exposed to air. To prevent exposure to drafts of air the patient kept the lips closed. The neighboring teeth were sound and had not been traumatized.

On closer examination it was found that the entire incisal edge had been fractured and the pulp was seen protruding from inside the tooth.

An Intraoral periapical X ray picture was taken to check for the extent of root development and any other hidden fractures in the neighboring teeth. The roots of both the central incisors were nearly complete in their length but the apical constrictions were not formed in both the central incisors. They were both having a blunderbuss foramen at the root apex. Figure 1

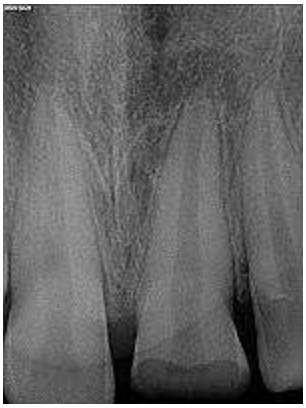

figure1

The maxillary and mandibular teeth were both protruding most probably due to a tongue thrust. The edge of the mandibular incisor was touching the lingual side of the fracture line of the upper central incisor suggesting that the teeth arrangement may have predisposed the patient into having a “trauma–prone” tooth profile.

A pulpotomy was planned up to the level of the CEJ of the upper left central incisor. A MTA vital pulpotomy was planned. However neither was MTA available as it out of stock in our clinic nor was it wise to wait for the supply of the same as the trauma was already 2 days old. So alternatively a Portland cement vital pulpotomy was planned. The patient’s parents were explained the situation and implications which they understood and consented without hesitation.

The tooth was anaesthetized with 2% Lignocaine with adrenaline. A rubber dam was placed on the tooth. The pulpotomy was done with a spoon excavator with a

long shank and also with a sterile autoclaved diamond chamfer cutting bur. The bleeding from the pulp was stopped by tamping the residual pulp stump with a sterile pellet of Lignocaine with adrenaline. Hemostasis was thus achieved.

Previous to the commencement of the pulpotomy the following process was carried out on White Portland cement (Birla White cement) which was directly collected from a fresh unused 1 kg sealed plastic bag. The cement was checked for any stone-like pebbles or any other obvious contaminants with the help of autoclave sterilized instruments. The cement powder was passed through a fine autoclaved sieve and only the powder that passed through was eventually used.

Next the sieved powder was spread over hot metal plate and this plate was directly held over a open flame for 10 minutes. After which the PC powder was stored in a autoclaved sterile container for use thereafter.

The PC powder was mixed with sterile distilled water in a manner similar to MTA and the moment a thick consistency was achieved was rolled into a roll and picked up with a cement carrier and placed inside the pulp chamber and gently packed with little to no pressure. At least a 5-6 mm thick layer was placed. The excess coated on the walls was removed with a sharp excavator and a sharp probe. Then a moist cotton pellet moistened with distilled water was placed on top of the PC. A second cotton pellet was placed on top of the first and excess water was absorbed away. The access was then dried properly and a 2-3mm thick layer of Fuji 2 Glass Ionomer cement was placed as a seal. Figure 2 and 3

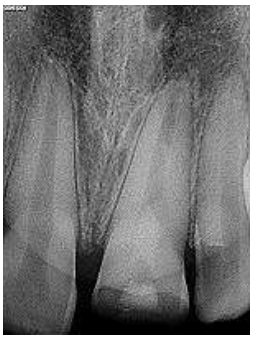

Figure 2

Figure 3

5 Days later the patient was called for a follow up. He had no pain, no sensitivity, tenderness what so ever. A radiograph was taken. The Glass ionomer seal was opened and a directly fabricated fiber-splint (Angelus) was fabricated and a very well matched composite core was fabricated.

5 months later the patient was called for a follow up. He had no complaints whatsoever and was satisfied with the treatment he received. A follow up X ray picture was taken. Figure 4

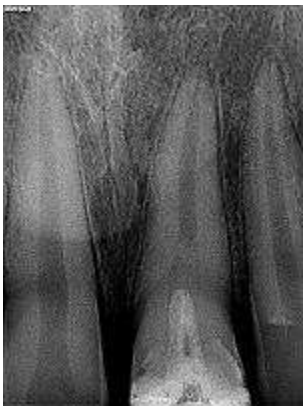

Figure 4

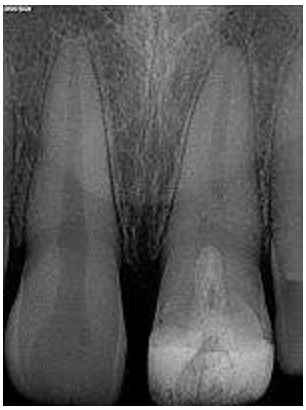

Figure 5

One year after that i.e. 16 months after the initial treatment the patient was again called for an annual recall. He was as asymptomatic as before. Fresh radiographs were taken. Figure 5

Results –

The five month radiographic recall picture clearly showed that preoperatively the apex was unformed but had now had formed in both, the treated tooth and the neighboring untreated central incisor which served as control. There was also a clearly identifiable dentinal bridge between the Portland cement and the Pulp. Figure 3

The sixteen month postoperative radiograph showed that the apical constriction development in the treated left central incisor was a bit more pronounced then on the control tooth. The dentinal bridge was well defined and clearly identifiable. Figure 5

There was a mild periapical widening of periodontal ligament space seen all around the apical 3rd of the root apex of the left central incisor seen in all the radiographs from the preoperative to the latest recall radiographs. There was no corresponding pain on percussion or any tenderness. This was attributed to mild trauma from occlusion. Figure 1, 2, 3 and 5

Discussion-

Vital Pulp Therapy –

Pulpotomy is an established treatment procedure. Vital Pulp Therapy was done by partially amputing pulp and placing CaOH over the vital left over stump or by placing CaOH over traumatically exposed pulp. The CaOH encouraged the formation of a dentin bridge. With the advent of MTA it showed similar capability.[1,6,16]

MTA pulpotomy was a recent development.1 Amputing a pulp and then placing a MTA seal over it ensures dentin bridge formation too.1 Regarding the issue regarding which is better, Calcium hydroxide or MTA has been dwelt at length by Panuroot et al in their paper.2 It is known that CaOH pulpotomy does not work in cariously infected and inflamed pulps.

However L.H. Chueh and C.P. Chiang3 have shown a case where even cariously affected pulp has repaired itself in spite of clear cut clinical signs of pulpal inflammation and lingering pain after cold application.

A review of the literature showed that when MTA and PC get hydrated after mixing with water the byproduct released was Calcium Hydroxide.4,6 The action of CaOH is that it produces necrosis in the pulp adjacent to the Calcium Hydroxide. However in the pulp adjacent to the MTA the pulp necrosis was lower. Histologically it was found MTA performed better than Calcium hydroxide.[5]

Material Discussion –

MTA is slightly different from regular Portland cement. For all practical purposes nearly all the physical, chemical and biological properties are the same. The notable difference if any are that commercially sold MTA contains bismuth oxide which is a radiopacifier. The other being that that MTA is sold sterile and the quality is consistent for all the packets. Hence MTA offers predictable and consistent quality.

Portland cement is manufactured for the purposes of building construction and has over the century, due to market needs, multiplied into wide variety of types and grades. So the contents also vary from one type to another and one manufacturer to another. Even the contents of construction cements manufactured vary according to geographical location as the raw materials change. Accordingly the behaviour of each cement type will vary to some extent.

Also Portland cement is not sold as a sterile powder. In endodontic procedures MTA and PC are used in areas where it will surely come in contact with live tissues so there is a fear of transmitting microbes to the patient through non sterile PC.

All the above are fears about the direct use of Portland cement. The factual realities of Portland cement throw a different light on these fears.

The sterilization and contamination of Portland cement has been studied by James H. Simon et al. They have stated that Portland cement is manufactured at 1500o C and hence it is manufactured sterile. Secondly they have stated that the high alkalinity of Portland cement prevents bacterial growth. Thirdly they have stated that contamination may occur during packing and shipping. Lastly they have recommended that dry heat of 170o C for 1 hour be used to sterilize Portland cement. They have demonstrated that dry heat will stop microbial growth in contaminated samples.[7]

In animal studies in mice done by Daniel Araki Ribeiro et al they have concluded that “the results clearly indicate that MTA and Portland cements had no cytotoxic effects in mouse lymphoma cells. In the same way, all root-end-filling materials tested did not induce DNA damage as depicted by the single cell gel (comet) assay. The results presented here might be an additional argument to support the use of MTA and Portland cements in dental practice.” [8]

In a study conducted study conducted by Duerte et al at Brazil they found arsenic release from Portland cement and MTA was same and in both of them was well below

the acceptable limits. Both materials were found to be equally biocompatible in animal studies.[9] Another study stated that MTA released more arsenic then permitted.[11]

Hexavalent chromium which is present in Portland cement can lead to allergic dermatitis.[10,11] The Portland cement manufacturing industry data clearly states that "Portland cement is not recognized as a carcinogen by NTP, OSHA, or IARC. However, it may contain trace amounts of heavy metals recognized as carcinogens by these organizations. In addition, IARC classifies crystalline silica, a trace constituent, as a known human carcinogen."[11]

An article published in The Journal of Endodontics states that "Both MTAs released more arsenic than the amount specified in ISO 9917-1 (2007). Portland cements and MTAs showed evidence of heavy metals in the acid-soluble form as well as leaching in deionized water and SBF. MTA contained levels of arsenic higher than the safe limit specified by the ISO 9917-1 (2007)."[12]

Yet another study by Chang SW et al states that "Arsenic and lead concentrations were the highest in GPC ($P < .05$). GPC had much more of 7 heavy metals than the other 3 cements ($P < .05$). GMTA and WMTA had higher purity than GPC and WPC ($P < .05$), particularly when arsenic content was considered." where they concluded that "If a clinician is considering using Portland cement versus MTA, the differences in purity may be considered."[13]

Again Montero Bramente et al studied numerous MTA and PC products and found that "All tested materials presented arsenic in their composition. The form of arsenic was not analyzed nor the toxicity of the arsenic found. Only MTA-Obtura, White MTA-Angelus, and White Portland cement presented arsenic levels below the limit set in the ISO 9917-1 standard."[16]

However Gustavo De Deus et al have shown different results when they compared GMTA, WMTA, GPC, WPC they have concluded that "Overall, the present study showed that all cements showed insignificant amounts of type III arsenic as well as no trace of arsenic DMA and type V could be detected."[14]

Also in a literature review done by Talita Ribeiro Tenório de França TR et al they have concluded that "PC has physical, chemical and biological properties similar to MTA. Concerning arsenic presence and release, it was concluded that the levels are low, therefore, unable to cause toxic effects. However, further researches are needed to assure its safety and suitability in clinical practice."[15]

Finally R. Steffen and H. van Waes have summarized thus "It should be mentioned that to date PC has undergone more tests to show its suitability for clinical use, then MTA materials in 1995. PC intendedfor clinical use should be tested for any pollution effects by heavy metal ions, should be sieved to unique particle size and sterilized, all to fulfill practices of good manufacturing. PC has a great potential to be used as a root-filling material. However, a serious selection of the material for clinical use and subsequent tests shall ensure that as used PC meets the medical device requirements set out by appropriate medicalregulation authorities."[18]

Conclusion –

• Portland cement is same as MTA except for the heavy metal content which may vary

• Biologically Portland cement behaves identical to MTA in living tissues

• Used for the same applications PC will behave similarly.

• MTA has been approved for use in dentistry while some countries prohibit use of PC.

• Reasons offered for discouraging PC use are heavy metal content and lack of sterilization

• Sterilization of PC is easily achievable by a clinician

• Occasionally even MTA has shown presence of arsenic although it is manufactured in a way that will prevent arsenic and heavy metals being incorporated into it

• Arsenic or any heavy metal content if at all leached from the MTA or PC is too small to produce any significant short or long term damage and animal studies have not proved any such damage causing capabilities

• From the above it appears that what is significant is not how much heavy metal or arsenic is there in the MTA or PC to begin with, rather, the sum total quantity of MTA/PC the patient is exposed to which finally matters.

• The quantum of exposure to Portland cement in a PC manufacturing, packing, transporting, storing and use by construction workers who work with PC is far much more than the patients in dentistry who are exposed in endodontics. Even living in an area where a lot of construction activities are going on will expose the residents to a large quantity of Suspended PC particles in air. As compared to that the exposure to PC in endodontics which is far too minimal.

• The excuse that PC is unsafe does not seem tenable with the mounting evidence that in practice PC is as safe as MTA considering that the quantum of MTA or Portland cement used is very small and any toxic metal leached will be clinically insignificant.

• Food and drug authorities across the globe need to reconcile to the fact that PC has been sidelined over MTA for unjustifiable reasons.

• PC will offer a cheaper endodontic solution and make endodontic treatment economical and the objections raised against the use of PC in dentistry are untenable.

References:

1. Clinical Affairs Committee – Pulp Therapy Subcommittee "Guideline on Pulp Therapy for Primary and Immature Permanent Teeth" Reference Manual V 34 / No 6 12 / 13. American Academy Of Pediatric Dentistry Council on Clinical Affairs 2009

2. Panuroot Aguilar, MSc, DDS, and Pairoj Linsuwanont, DDS, MDSc, PhD "Vital Pulp Therapy in Vital Permanent Teeth with Cariously Exposed Pulp: A Systematic Review" JOE — Volume 37, Number 5, May 2011

3. L-H Chueh, C-P Chiang "Histology of Irreversible Pulpitis Premolars Treated with Mineral Trioxide Aggregate Pulpotomy" Operative Dentistry, 2010, 35-3, 370-374

4. Josette Camilleri "A review of the methods used to study biocompatibility of Portland cement-derived materials used in dentistry" Malta Medical Journal Volume 18 Issue 03 October 2006

5. Mercedes S. Dominguez, David E. Witherspoon, James L. Gutmann, Lynne A. Opperman "Histological and Scanning Electron Microscopy Assessment of Various Vital Pulp-Therapy Materials" Journal of Endodontics Volume 29, Issue 5, May 2003, Pages 324–333

6. Holland R, Souza V, Nery MJ, Otoboni JA, Filho, Bernabe PFE, Dezan E Jr. “Reaction of rat connective tissue to implanted dentin tubes filed with mineral trioxide aggregate or calcium hydroxide.” J Endod 1999;25:161-6.
7. James H. Simon, Samuel W Oglesby, Rafael A. Roges, Ramon G. Roges, Roberto Roges, Pauline Chan G., Dr. Jorgen Slots, “Sterilization of Portland Cement” , Endodontics, 8540 Sepulveda Boulevard, Suite 1117, Los Angeles, California 90045. USC School of Dentistry microbiology lab.
8. Daniel Araki Ribeiro, PhD, Marco Antonio Hungaro Duarte, PhD, Mariza Akemi Matsumoto, PhD, Mariangela Esther Alencar Marques, PhD, and Daisy Maria Favero Salvadori, PhD “Biocompatibility In Vitro Tests of Mineral Trioxide Aggregate and Regular and White Portland Cements” JOE — Volume 31, Number 8, August 2005
9. Marco Antonio Hungaro Duarte, PhD,a Ana Claudia Cardoso de Oliveira Demarchi, MS,b
Jose´ Carlos Yamashita, PhD,a Milton Carlos Kuga, PhD,a and Sylvio de Campos Fraga, PhD,a
Bauru, Brazil Sagrado Corac¸A˜ O University. “Arsenic release provided by MTA and Portland cement” Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2005;99:648-50
10. “Construction Information Sheet No 26 (revision2)” HSE information sheet published 12/02. HSE UK.
11. “Material Safety Data Sheet For Ambuja HiRise Cement (Further on referred to as Portland Cement)” “Ambuja Portland Cement manufacturing company India” issued safety directive for users
12. Mathew Schembri BSc, George PeplowPhD, Josette Camilleri PhD “Analyses of Heavy Metals in mineral Trioxide aggregate and Portland cement” JOE volume 36, issue 7 pages 1210-1215 July2010
13. Chang SW, Shon WJ, Lee W, Kum KY, Baek SH, Bae KS. “Analysis of heavy metal contents in gray and white MTA and 2 kinds of Portland cement: a preliminary study.” Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2010 Apr;109(4):642-6.
14. De-Deus G, de Souza MC, Sergio Fidel RA, Fidel SR, de Campos RC, Luna AS. “Negligible expression of arsenic in some commercially available brands of Portland cement and mineral trioxide aggregate.” J Endod. 2009 Jun;35(6):887-90.
15. Talita Ribeiro Tenório de França TR, da Silva RJ, Sedycias de Queiroz M, Aguiar CM. “Arsenic content in Portland cement: A literature review.” Indian J Dent Res 2010;21:591-5
16. Monteiro Bramante C, Demarchi AC, de Moraes IG, Bernadineli N, Garcia RB, Spångberg LS, Duarte MA. “Presence of arsenic in different types of MTA and white and gray Portland cement.” Oral Surg Oral Med Oral Pathol Oral Radiol Endod. 2008 Dec;106(6):909-13. Epub 2008 Oct 4.
17. Vidya Srinivasan, Paula Waterhouse & John Whitworth “Mineral Trioxide Aggregate In Paediatric Dentistry” International Journal of Paediatric Dentistry 2009; 19: 34–47
18. R. Steffen, H. van Waes “Understanding mineral trioxide aggregate/Portland-cement: A review of literature and background factors” European Archives of Paediatric Dentistry // 10 (2). 2009

Holt-Oram Syndrome – Report of a rare case

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Abstract:

Holt-Oram Syndrome is a rare autosomal dominant heritable disorder with complete penetrance & variable expressivity, mainly characterized by skeletal upper limb dysplasias & congenital cardiac defects. Over 350 cases have been reported in medical literature.

Here we report a 6 year old male patient which reported to us with a complaint of multiple decayed teeth or rampant caries and defective upper limbs. Through history revealed cardiac abnormalities and was collectively diagnosed as Holt-Oram Syndrome.

Key-words: Holt-Oram Syndrome, upper limb anomalies, heart hand syndrome, cardiac limb syndrome .

Case history:

6 year old boy accompanied by his parents reported with a chief complaint of decayed teeth and associated mild pain.

There was no history of consanguinity, prenatal and antenatal history was non contributory. The developmental milestones of the child was normal as reported by the parents.

A probe into child's medical history showed that he had been diagnosed with cardiac murmurs. The child shows no signs of mental retardation and according to parents, the child was intelligent academically and also showed good grades at school.

Patient was solely co-operative for general physical examination, revealed deformities of upper limbs with narrow shoulders. Both hands showed missing thumb; the left upper limb comprised of only 2 digits, which was accompanied by muscle dystonia (fig 3). Lower limbs appeared normal.

Patient had a tilted stance (fig 3), with pectus excavatum & a short neck.

Extraoral examnation revealed a facial asymmetry with mild hypertrophy towards the left side, patient was brachycephalic (fig 2) with frontal bossing and increase in AP diameter of the skull (fig 2). Left supraclavicular and bilateral submandibular

lymph nodes were enlarged, tender, firm and mobile.

Intraoral examination showed rampant caries (fig1), suggestive of lack of dexterity.

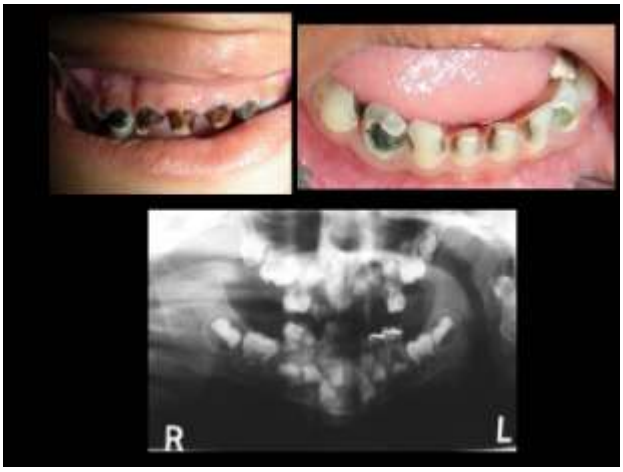

Figure 1: Clinical photograph of Rampant caries and OPG

OPG showed extensive caries with pulpal involvement of almost all deciduous teeth with extensive carious lesion involving and normal appearing permanent tooth and tooth buds. The bony architecture appeared to be normal (fig 2).

PA Skull (fig 2), showed slight tilt of the head, owing to the posture, lateral skull (fig 2) showed an increase in the AP dimension of the skull,

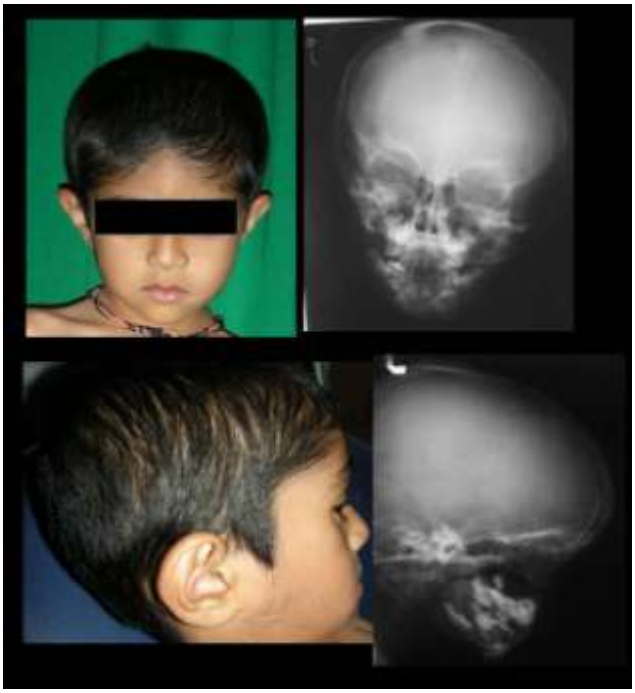

Figure 2: photographs of PA view & Lateral View of skull & face and also Radiographs of PA Skull & Lateral Skull showing increased AP dimension of skull

Right hand showed absence of thumb, left hand showed the presence of only two digits, also showed hypoplasia of ulna and hypoplasia & forking of radial bone (fig 3). However trabecular pattern appeared to be normal.

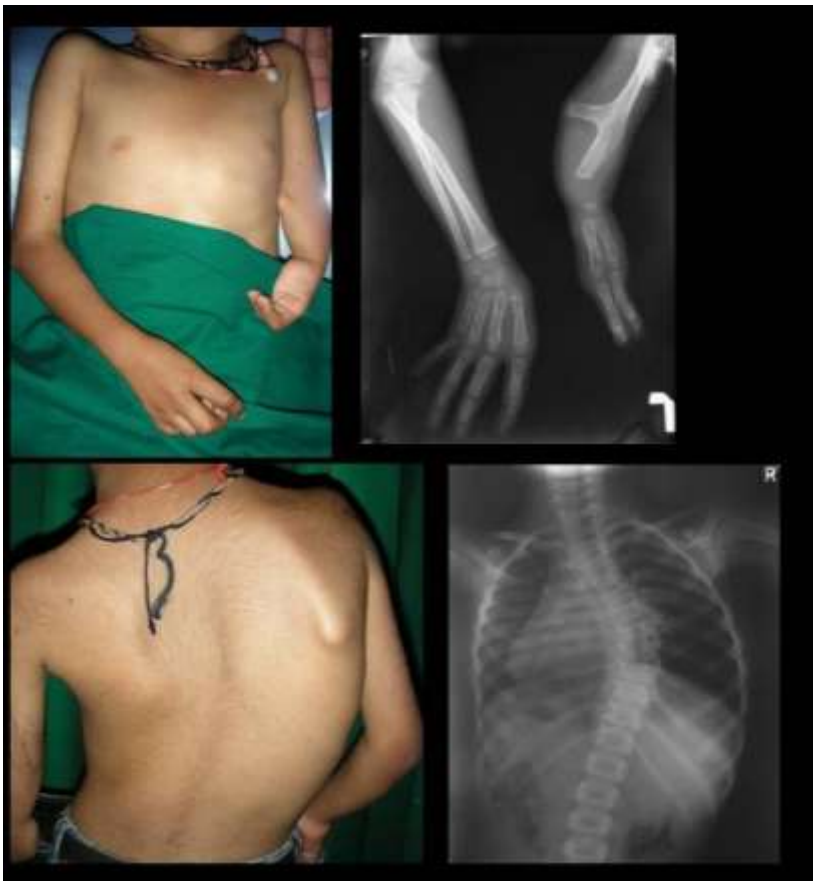

Figure 3: Photographs and Radiographs of the upper limbs & chest showing hypoplastic upper limbs, Kyphoscoliosis & pectus excavatum

Chest PA showed marked kyphoscoliosis (fig 3), however all other bones of the ribs and clavicle appeared to be normal.

Reviewing of literature coincided with the features of the rare disorder, Holt-Oram Syndrome.

Parents were informed about the disease and was treated for the dental condition. He was referred to the pediatrician and his cardiac functions have to be constantly monitored. His siblings and other family members were subjected for examination but were non-contributory.

Discussion:

Synonyms: Heart hand syndrome, Cardiac limb syndrome

Holt-Oram Syndrome(HOS), was first reported in 1960 by Mary Clayton Holt and Samuel Oram who detected an atrial septal defect(ASD) in members of four generations of a family. ASD was associated with “a congenital anomaly of thumbs which lay in

the same planes as the fingers, their terminal phalanges being curved inwards". They described the triad of ASD, conduction disturbances and hand malformations.8

HOS is an inherited disorder that causes anomalies of the upper limbs and heart. The syndrome is transmitted as an autosomal dominant trait that is highly penetrant, although the clinical manifestations vary and range from subclinical radiographic findings to overt, life-threatening disease. HOS in 30-85% cases occurs in isolated cases7. Prevalence is approximately 1 in 1,00,000 live births [1,2,4,8]. Over 300 cases have been published revealing a wide spectrum of clinical signs 1.

Underlying genetic defect was found on the long arm of chromosome 12q2 [2]. Mutations in the TBX3 and TBX5 genes lead to a wide range of phenotypes typical of HOS [1,2]. These genes play an important role in skeletal and cardiac development. 85 percent of cases are attributed to new mutations [2].

Upper-limb anomalies are always present [8]. These may be unilateral or bilateral and involve structures derived from the embryonic radial ray, typically the radial, carpal, and thenar bones. All gradations of defect in the upper limb and shoulder girdle. The thumbs may be absent, hypoplastic, triphalangeal or bifid. Syndactyly often occurs between thumb and index finger; phocomelia(10%); asymmetric involvement with left side more severely affected [8] is frequently seen as in our case. Clinodactylt; brachydactyly; hypoplasia to absence of first metacarpal and radius; defects of ulna, humerus, clavicle, scapula, sternum are often seen.

Decreased range of motion at elbows and shoulders, which are often narrow and sloping; carpel anomalies are particularly involving scaphoid which is often hypoplastic or has a bipartite ossification.

Approximately 50% of the patients have cardiac malformations [6]. Osteum secundum atrial septal defectand ventricular septal defect have been the most common defects. About one third of patients have had other types of congenital; conduction defects; hypoplasia of distal blood vessels[1,3,6,8].

Occasional abnormalities includes, hypertelorism, absent pectoralis major muscle, pectus excavatum, thoracic scoliosis [8], vertebral anomalies, absence of one or more ossification centers in the wrist, sprengel deformity, post axial and central polydactyly, lung hypoplasia, refractive errors.

The survival of the patients depends on the severity of the cardiac anomalies. Genetic counseling is recommended [1].

Although cardiac signs were minimal, upper limb defect is the major feature with most of the findings is consistent with the reported cases of Holt Oram Syndrome [8].

Further, Prenatal 3 dimentional sonography and fetal echocardiography can be an important diagnostic aid in depicting the characteristic upper limb anomalies and cardiac abnormalities.

References:

1. Bossert T, Walther T,Gummert J, et al Holt Oram syndrome Orphanet Encyclopedia, April 2003
2. Basson CT, Cowley GS, Solomon SD, Weissman B, Poznanski AK, Trail TA, Seidman JG, Seidman CE. The clinical and genetic spectrum of the Holt-Oram syndrome (heart-hand-syndrome). N Engl J Med. 1994;330: 885–891.
3. Carsten J. Brockhoff, MD; Henning Kober, MD; Nikos Tsilimingas, MD; Friedhelm Dapper, MD; Thomas Mu¨nzel, MD; Thomas Meinertz, MD. Holt-Oram Syndrome. Circulation 1999;99;1395-1396
4. Waldo Sepulveda, Gabriela Enriquez,Jose L. Martinez, Ricardo Mejia. Holt-Oram Syndrome Contribution of Prenatal 3-Dimensional Sonography in an Index Case. J Ultrasound Med 2004; 23:983–987
9. 359
5. Charalampos Rallis, Benoit G. Bruneau, Jo Del Buono, Christine E. Seidman, J. G. Seidman, Sahar Nissim, Clifford J. Tabin and Malcolm P. O. Logan. DEVELOPMENT AND DISEASE Tbx5 is required for forelimb bud formation and continued outgrowth. Development (2003) 130, 2741-2751
6. Michael Bo¨hm. Holt-Oram Syndrome. Circulation 1998;98;2636-2637
7. S.Shono, K.Higa, K.Kumano, K.Dan. Holt-Oram Syndrome. British Journal of Anaesthesia1998;80;856-857
8. Holt-Oram Syndrome (Cardiac-Limb Syndrome). Schmidt's recognizable patterns; 358-